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GRAPHIC TECHNOLOGIES AND COMMUNICATIONAL BEHAVIOUR IN ECOLOGICAL CRISES

GRAFIČKE TEHNOLOGIJE I KOMUNIKACIJSKO PONAŠANJE U EKOLOŠKIM KRIZAMA

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Abstract

Irrational use of natural resources has led to ecological crisis, „environmental crisis", „crisis of raw materials", „energy crisis" that has resulted in many socio-economic problems, which results with changes in human communication behaviour. When we talk about graphic technology, technological progress has led to rapid growth of influence and importance of the press, but also to the accelerated devastation of limited natural resources and preventing the necessary time to complete their cycle of renewal. Media content by its form adapts the development of ICT technology. Medias are forced to change because of increasing number of Internet users, mobile networks and other advanced communications channels. Today we are witnesses and users of new media which allow us to completely replace paper as a medium for disseminating information. All these changes can be seen as a cultural, social and communicational process of technologies adapting to the process of creating new models of living and understanding of all citizens on important issues for the development of man and society as a whole. By using the method of synchronic and diachronic analysis and synthesis, and also causal non-experimental method of empirical research, the authors explore the basis of the hypothesis that (non) ecological awareness of users of media content affects their communication behavior, and thus the development of new graphic convergent technologies. Used instrument for measurement was non-standardized questionnaire. Empirical research was conducted between October 15th to November 1st 2011., on sample of 214 respondents who belong to the student population. This group was selected because they belong to a population which largely uses new technology for communication, and their habits and communication choices will determine trends in the development of communication technologies in the future.

Sažetak

Neracionalno korištenje prirodnih resursa dovelo je do ekološke krize, «krize okoline», «krize sirovina», «krize energije», koja je rezultirala brojnim socijalno-ekonomskim problemima, koji rezultiraju promjenama u čovjekovu komunikacijskom ponašanju. Kada govorimo o grafičkoj tehnologiji, tehnološki napredak doveo je do rapidnog rasta utjecaja i važnosti tiska, ali i do ubrzanog devastiranja ograničenih prirodnih resursa i onemogućavanja potrebnog vremena da se završi ciklus njihove obnove. Medijski se sadržaj svojom formom prilagođava razvoju ICT tehnologije, na što su mediji prisiljeni sve većim brojem korisnika Interneta, mobilnih mreža i ostalih naprednih komunikacijskih kanala. Danas smo svjedoci i korisnici novih medija koji nam omogućuju potpunu zamjenu papira kao medija za širenje informacija. Sve te promjene mogu se promatrati kao kulturološki, socijalni i komunikološki proces prilagodbe tehnologije u procesu stvaranja novih modela življenja i sporazumijevanja svih građana o bitnim pitanjima za razvoj čovjeka i društva u cjelini. Metodom sinkronijske i dijakronijske analize i sinteze, te kauzalne neksperimentalne metode empirijskog istraživanja, autori istražuju utemeljenost hipoteze da (ne)ekološka svijest korisnika medijskih sadržaja utječe na njihovo komunikacijsko ponašanje, te time na razvoj novih konvergentnih grafičkih tehnologija. Upotrebljeni instrument mjerenja čini nestrandardizirani anketni upitnik. Empirijsko istraživanje je provedeno u razdoblju 15.10.-1.11.2011., na uzorku od 214 ispitanika koji pripadaju studentskoj populaciji. Ova skupina je odabrana jer pripadaju populaciji koja u velikoj mjeri koristi nove tehnologije za komuniciranje, te će upravo njihove navike i komunikacijski odabiri određivati i trendove razvoja komunikacijskih tehnologija u budućnosti.

1. Introduction

We live and work in a time of sudden and often dramatic ICT changes, which are happening to individuals, families, societies and countries around the world. The dynamic development and continuous evolution of communication are the hallmarks of human society since its inception, but they have never had such a strong impact on the environment. The causes are probably demographic - there is no doubt that the large world population has a great impact on the use of limited natural resources and the cycle of renewal. Today's science says that man's origin started somewhere around two million years ago. Demographers estimate that the humankind at that time numbered some 2.5 million inhabitants. As they calculated, the world in about 1650, had a half a billion people (...) For the next 200 years, it the 1850th the world again doubled, the population has risen to one billion. So dense human kind could be maintained and further developed only by intensifying communication processes – in that time through the press, which has in almost 300 years experienced an unprecedented explosion /**1**/.

Information reproduction allowed the dissemination of knowledge, access to information, more independent opinion making and active participation in life and community development. The invention of printing enabled the Enlightenment, the democratization of society, the progress of human society towards equality and freedom of thought. Even Plato emphasized that language is materialized in the form of written communication /**2**/ - the written word (written communication) is the act of gaining independence from the author, it becomes part of the public sphere. Completeness of this statements happened with the invention and the development of the print media. With its recording, the information becomes part of history, and thus the author leaves his mark in the historical heritage of humanity.

When it comes to graphic technology, technological progress has led to rapid growth of influence and importance of the press, but also it led to the accelerated devastation of the limited natural resources and preventing the necessary time to complete the cycle of renewal. Certainly, today, the press found it self in front of the challenges of new technologies and in some ways, it must fight for its communication role in the media of the future. More than ever, the print is exposed to changes in the technological process - the rapidly increasing amount of knowledge, the power of technology has reflected to printing technology. Technology has changed, the production process has changed, chemistry has developed, also mechanics, engineering, computer science, but the final product of the printing press remained the same - words, pictures, human thought, the information printed on paper. Today we are witnesses and users of new media that allow us to completely replace paper as a medium for disseminating information. All these changes can be viewed as the cultural, social and communicational process of technology adjustment in the process of creating new models of living and understanding of all citizens on important issues for the development of man and society as a whole. Today, on the planet are living more than seven billion people, hence the increased communication needs have led to the development of new communication technologies, which now are playing the social role, which was, in not so distant past, played by a printing technology.

With the development of science and technology, people have become "masters" of planet Earth. They therefore interpret the overall balance in its extent, on a human scale. Ecology then becomes a one-way process because man is seeing everything from the perspective of his own well-being. By the development of mankind, one part of humanity is enjoying higher standard of living, using more resources and thus threatens the future quality of life of all mankind. Man has become the main suppressant of natural balance of Earth /**3**/. Anthropological assimilation involves an active relationship towards the entire human environment, which is best reflected in the process of feeding - where man with his own energy is consuming nutrients from nature reworking them into new substances. To what can not be transformed, man is adjusting or accommodating, he is being passive: he protects himself with clothing and fire from rain and snow, in natural disasters he heedlessly runs away /**4**/. In short, the overall balance is achieved with not going against nature. But unfortunately, that mankind does not live that way. Most scientists agree that the man contributed to global climate changes in the 20th century.

2. Theoretical frame of the research

Irrational use of natural resources has led to ecological crisis, "environmental crisis", "crisis of raw materials, "energy crisis" that resulted in a number of socio-economic problems. The fact is that the debate about the environmental crisis begins by considering the economic constraints within the advanced industrial societies. On the one hand, we have the scarcity of raw materials and energy, on the other hand, there is a growing environmental pollution, so the scientists started to deal with this problem in the seventies/**5**/. Reactions in the public regarding the environment have led to the creation of the "green" movement, aimed at protecting

the environment. Beginnings of emergence of this movement, as well as increasing public concern regarding environmental issues can be found in the report which was first published in the early 70's titled "The Limits to Growth" which was printed by the Roman club, an organization that was founded by a group of intellectuals, economic advisers and civil activists. Roman club commissioned the research, which with using computer models showed a tendency of further development, given the observed factors. The main conclusion of the Roman club report was that the rate of industrial growth is incompatible with the limited amount of global resources and ability to withstand the world population growth, industrialization, pollution, resource depletion, etc. /**6**/.

New products and services are constantly evolving. Digitalization of the media imposes the need for active participation in technological change, therefore, the media, more or less successfully, are trying to cope and adapt their actions in time when technological developments are affecting their position. Assessment of the impact of new media on the environment met with many challenges and unanswered questions, but at the same time, it is an opportunity to take proactive measures to prevent any possible consequences for the environment /**7**/ . It is estimated that 80% of the impact of a product to an environment is defined already in the design phase, therefore is very important issue to take into consideration when developing new technologies /**8**/. Media content adapts the development of ICT technologies -the media are forced to do that because of a growing number of Internet users, mobile networks and other advanced communications channels. Technological progress has led to new consumer habits. Media magnate Rupert Murdoch /**9**/ has predicted a gloomy future for newspapers, and said: "The trends are turning against us. Until we awake to these changes that are quite different from those of five or six years ago, we, as an industry, have a second-class status. For all of us, it is a challenge to create a place on the internet that is good enough to state the customer to ask for your homepage. Just as people traditionally began their day with coffee and a newspaper in the future the way they began their day will be a cup of coffee and our web-site. "

3. Methodological concept of the research

3.1 Problem approach

The ecological crisis is a process of menace of mutual mediated natural and socio cultural systems on a global scale, with uncertain duration and depth /**10**/. In this research, we are focusing on consumer behavior, not on the processes of reproduction of the media materials.

3.1.1 Research objectives, methodology and time frame of the research

The main research objectives are:
- to determine do students consider themselves to be environmentally conscious ;
- what is the connection with their perception and their actual behavior, which ultimately affects to the development of new convergent media technologies.
- to determine whether there are differences between students with different education background.

Clarification of this problem is approached through the concepts of environmental awareness and ecological behavior. The starting hypothesis of the research is aims at possible research results which hypothetically point that (not)ecological awareness and (not)ecological behavior of consumers affects the communication decisions of the people about media usage. The basic methods that the authors are using are synchronic and diachronic analysis and synthesis and causal non-experimental method of empirical research, in order to form new conclusions and point out the open issues for further research. The empirical part of the research was conducted from 15th September to 1st November 2011. All obtained results and conclusions are derived based on the data gained in the specified time limits.

3.1.2 Defining the sample

The sample included altogether 214 students. 109 are students of the Faculty of Graphic Arts, out of which 38% are male and 62% are female. 105 are students of the Faculty of Political Sciences , out of which 44% are male and 56% are female. Both groups are quite equal regarding the faculty, but there is a higher number of female participants from both faculties.

Faculty	Gender				Altogether
	M	f(%)	F	f(%)	
Faculty of Graphic Arts	42	38	67	62	109
Faculty of Political Sciences	46	44	59	56	105
Altogether	88	41	126	59	214

Table 1: Number and structural percentage (f %) of students according to gender and faculty

This population was chosen because they, in a large number, are using new technologies for communicating, therefore their habits and communicational choices will determine development trends of communication technologies in the future.

3.1.3 Research pattern and statistical data processing

The questionnaire contained 19 questions divided into two comparable parts. 9 questions were focused on attitudes regarding the (non)ecological behavior, and the other 10 questions were questions regarding the application of (non)ecological behavior. The questions are primarily focused on determining general attitudes toward ecology, and then to (non) ecological behavior, especially in the application of new media technologies.

The data was processed by computer with SPSS 17.0. They were processed on the level of descriptive and inference statistics. The following procedures were used:

- the frequency analysis for individual variables of attitudes about (non)ecological awareness and (non)ecological behaviour ;
- non-parametrical statistical test: Mann – Whitney U test for two independent samples (to determine the differences in the frequency of attitudes about (non)ecological awareness and (non)ecological behaviour;
- non-parametrical statistical test: Spearmanov rho (rs) – to determine correlation between (non)ecological attitude („I consider myself environmentally conscious person") and (non) ecological behaviour.

4. Analysis of data

4.1 Frequency analysis of ecological principales in attitudes towards ecological behaviour

First set of questions aimed at determinig the self-evaluation of the ecological behavior and general attitudes about ecological behavior.

Table 2. shows that 50% of students consider themselves to be environmentally conscious person. 27,6% mostly agree with this statement (among them there is a greater number of students from Faculty of Graphic Arts) and over 20% of questioned students do not think about this topic at all.

This statment is very general, so we believe that this number would drop if we try to connect specific types of behaviour with this statement.

Legend / FGA = Faculty of Graphic Arts
FPS = Faculty of Political Sciences

	Completely agree				Mostly agree				Strongly disagree			
	FGA		FPS		FGA		FPS		FGA		FPS	
I consider myself environmentally conscious person.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	52	47,7	55	52,4	38	34,9	21	20,0	19	17,4	29	27,6
Total	N=107 (50%)				N=59 (27,6%)				N=48 (22,4%)			

Table 2. Estimate of environmental consiousness

Table 3. Shows that students are quite aware of problem of pollution. Over 60% of them believes that the planet is very polluted and only 13,1% believes that the planet is not polluted at all.

	Planet Earth is not polluted				Planet Earth is polluted				Planet Earth is very polluted			
	FGA		FPS		FGA		FPS		FGA		FPS	
Pollution of the Earth	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	8	7,3	20	19	27	24,8	29	27,6	74	67,9	56	53,3
Total	N=28 (13,1%)				N=56 (26,2%)				N=130 (60,7%)			

Table 3. Estimate of the Earth pollution

It is interesting that students are not willing to accept personal responsability for the Earth pollution. It seems that they are aware of the problem, but do not consider themselfs responsible for it. So, 54,2% of them is willing to partially accept the responsibility and only 19,6% of them completely agrees that they are also responsible for the Earth pollution. The results are shown in table 4.

	Completely agree				Mostly agree				Strongly disagree			
	FGA		FPS		FGA		FPS		FGA		FPS	
I consider myself personally responsible for the pollution of the Earth.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	26	23,9	16	15,2	59	54,1	57	54,3	24	22	32	30,5
Total	N=42 (19,6%)				N=116 (54,2%)				N=56 (26,2%)			

Table 4. Personal responsibility for the pollution of the Earth

Greenpeace estimates that the worldwide volume of electronic waste is close to 50 million t per year. Some states have programs for recycling, but nothing beyond that - electronic waste is exported to other countries. The amount of electronic waste is rapidly increasing, that is why many international environmental groups raised the alarm, calling on producers and consumers, and government institutions to urgently take measures of control over electronic waste.

Table 5. shows that the students are aware of eletronic waste problems, although students of the Faculty of the Political Sciences are less aware – only 21% of them completely agrees that efficient disposal of electronic waste is important.

	Completely agree				Mostly agree				Strongly disagree			
	FGA		FPS		FGA		FPS		FGA		FPS	
Efficient disposal of electronic waste is important.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	56	51,4	22	21,0	32	29,4	41	39,0	21	19,3	42	40,0
Total	N=78 (36,4%)				N=73 (34,1)				N=63 (29,4%)			

Table 5. Opinion about eletronic waste disposal

Table 6. shows that over 50% of students support a refund for returned bottles. From this we can see that students support ecological efforts if they see a certain benefit for themselves. A greater number of students from Faculty of Graphic Arts strongly disagree with a refund for returned bottles.

	Completely agree				Mostly agree				Strongly disagree			
	FGA		FPS		FGA		FPS		FGA		FPS	
I support a refund for returned bottles.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	55	50,5	61	58,1	29	26,6	38	36,2	25	22,9	6	5,7
Total	N=116 (54,2%)				N=67 (31,3%)				N=31(14,5%)			

Table 6. Opinion about a refund for returned bottles

With the next question we wanted to see do the students find their education about the environment adequate. 67% of them think that the topics on environmental protection are adequately represented in education, but if we look at the structure of answers, we see that most of the students at the Faculty of Political Sciences find their education in this area inadequate.

	Completely agree				Mostly agree				Strongly disagree			
	FGA		FPS		FGA		FPS		FGA		FPS	
Topics on environmental protection are adequately represented in education.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	73	67,0	1	1	29	26,6	38	36,2	7	6,4	66	62,9
Total	N=74 (34,6%)				N=67 (31,3%)				N=73 (34,1%)			

Table 7. Representation of ecological topics in education

Benjamin Čulig /**11**/ divides individuals with regard to the source of information into three groups: those who receive information from mass media (these sources are numerous, but they have high level of sensationalism, thus obtained information must be checked), then those who primarily are determined by their profession and the third is the group that gains most information about the ecology from the social contacts. From the table 8., we can see that students from Faculty of Political Sciences can be put in the first type and the students from Faculty of Graphic Arts can be put in the second – group determined by their profession.

	At faculty				Through media				Through social contacts			
	FGA		FPS		FGA		FPS		FGA		FPS	
I inform myself about topics on environmental protection...	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	59	54,1	1	1,0	31	28,4	80	76,2	19	17,4	24	22,9
Total	N=60 (28%)				N=111 (51,9%)				N=43 (20,1%)			

Table 8. Informing about environmental topics

Printing industry is one of the major environmental pollutants. Printing industry is constituded of a wide range of printing techniques, such as flexo, digital printing, screen printing etc. and each of these techniques has an impact on the environment (land, air and water) because of materials and chemical materials used in the production process, and waste that their use creates. The main problems that the graphic industry creates to an environment can be classified into four main areas /**12**/:

- air pollution (the release of various chemical elements in the atmosphere)
- storage of hazardous materials and chemicals (such as solvents and photographic chemical waste)
- waste management, which includes reuse, recycling and disposal of paint, paper, printing forms and palettes
- energy use in the production process and transport (whose irrational use contributes to the greenhouse effect and climate change).

In the printing industry there are available techniques for reduction of environmental impact, related to the prevention of pollution, pollution control and system management.

Table 9. shows students estimation of graphic industry as a big environment pollutant . It seems that the students of Faculty of Graphic Arts are more aware of this ecological problem, what is understandable because they gain much more information about this during their education.

	Completely agree				Mostly agree				Strongly disagree			
	FGA		FPS		FGA		FPS		FGA		FPS	
Graphic industry is a big environment pollutant.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	59	54,1	28	26,7	35	32,1	35	33,3	15	13,8	42	40,0
Total	N=87 (40,7%)				N=70 (32,7%)				N=57 (26,6%)			

Table 9. Estimation of graphic industry as a big environment pollutant.

Table 10. shows the satisfaction about the available information about the ecological topics. The results are showing that students in general are satisfied with the information amount.

	are not enough				are enough				are too much			
	FGA		FPS		FGA		FPS		FGA		FPS	
I find available information about environment protection ...	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	57	52,3	33	31,4	43	39,4	62	59,0	9	8,3	10	9,5
Total	N=90 (42,1%)				N=105 (49,1%)				N=19 (8,9%)			

Table 10. Availability of information

From this set of data we can conclude that on the declarative level students have developed ecological awareness.

4.2 Frequency analysis of (non)ecological behaviour

The next set of questions is aiming at seeing what the students are actually doing in the sphere of ecological behaviour or is their eco-concience only declarative.

First question in this set, shown in table 11., shows that behavior is different than declarative statements. The other set of questions has shown that students are aware of environmental problems, that they support environmental actions – but they themselves do not recycle so much. 41,1 % of them never recycles.

	yes				sometimes				never			
	FGA		FPS		FGA		FPS		FGA		FPS	
I recycle.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	31	28,4	11	10,5	56	51,4	28	26,7	22	20,2	66	62,9
Total	N=42 (19,6%)				N=84 (39,3%)				N=88 (41,1 %)			

Table 11. Recycling

It seems that students are not aware of the concept of green web page and they do not use them often. Some of them use it sometimes and the greater number of them are students of Faculty of Graphic Arts. Web sites are defined as green, not necessarily because they deal with the ecology, or pages that deal with ecology do not necessarily have to use green design. Green web site is attractive, quick to open, easy to use regardless of the skill of the user /**13**/. Energy is saved by choosing dark background, eg. white background consumes 75W, while the black background consumes 59W. Students were explained what the green web page actually is.

	yes				sometimes				never			
	FGA		FPS		FGA		FPS		FGA		FPS	
I use green web pages.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	0	0	0	0	22	20,2	1	1	87	79,8	104	99
Total	N=0 (0,0%)				N=23 (10,7%)				N=191 (89,3%)			

Table 12. Using green web pages

Table 13. shows that there is a difference between behaviour of two groups of students. Students of Faculty of Graphic Arts are more willing to properly dispose electronic waste.

	yes				sometimes				never			
	FGA		FPS		FGA		FPS		FGA		FPS	
I properly dispose electronic waste.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	35	32,1	15	14,3	46	42,2	44	41,9	28	25,7	46	43,8
Total	N=50 (23,4%)				N=90 (42,1%)				N=74 (34,6%)			

Table 13. Disposal of electronic waste

When it comes to active participation in environment protection, students are completely uninterested. None of them is actively participating in environmental NGO.

	yes				sometimes				never			
	FGA		FPS		FGA		FPS		FGA		FPS	
I actively participate in an environmental NGO.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	0	0	0	0	0	0	0	0	109	100	105	100
Total	N=0 (0,0%)				N=0 (0,0%)				N=214 (100%)			

Table 14. Participation in an environmental NGO

Table 15. shows that the students are more willing to properly disclose old newspaper. This kind of behaviour is more simpler, because this disposal is taking much more less time than eletronic waste disposal.

	yes				sometimes				never			
	FGA		FPS		FGA		FPS		FGA		FPS	
I properly dispose old newspapers.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	67	61,5	58	55,2	23	21,1	6	24,8	19	17,4	21	20,0
Total	N=125 (58,4%)				N=49 (22,9%)				N=40 (18,7%)			

Table 15. Disposal of old newspapers

A comparison of print and electronic media has been topic of interest of many scientists (Hischier and Reichart, 2001; Toffel and Horvath, 2004; Yagita et al. 2003, Kozak, 2003). The results of their research say that to assess the environmental acceptability of the new media the most important factor is the time it takes the reader to read the contents. Specifically, the average reader need more time to read the same amount of content from an electronic screen than from paper. This leads to increased energy use (and thus an increased impact on the atmosphere and ultimately to climate change) in new media. Their research and comparison of television, print and the Internet have shown that the use of the Internet for about 25 min., watching television around 1 and a half hour and reading a newspaper has an equal impact on the environment /**14**/. Research conducted by Moberg et al. showed that if an individual is reading the paper on a desktop computer for 30 minutes, it has the same environmental effect as reading 40 pages of the printed editions. For electronic media, the greatest environmental impact is at the stage of consumption - due to the need of energy consumption to be able to use electronic devices. Therefore we can say that the role of consumers on the environmental impact is greater when using the new electronic media, while the traditional media more impact have the participants in the production process.

From table 16. We can see that students are not interested for energy saving.

	yes				sometimes				never			
	FGA		FPS		FGA		FPS		FGA		FPS	
I take care of the spending electrical power.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	0	0	0	0	23	21,1	0	0	86	78,9	105	100
Total	N=0 (0,0%)				N=23 (10,7%)				N=191 (89,3%)			

Table 16. Spending eletrical power

Media content is now available to us through newspapers, television, radio, Internet, mobile phones and devices for reading e-newspapers. Manufacturers of such devices in recent years are trying to develop technology that will be more like the print media (without reflection, high resolution, with the ability to read at an angle of 180 degrees and high contrast), and thus closer to potential customers. Sony produced the first device for e-newspapers in 2006 /15/. When we talk about environmental factors, devices like these contribute to less use of resources and to avoiding additional costs that appear in the print media - space, maintenance and cleaning of printing machinery, transport – these are now processes of information transfer that are not necessary. Regarding the

transfer of information and communication, these devices are more environmentally friendly than using a desktop computer or laptop for reading news, because they are using less energy. Berkhout and Hertin (2004) point out that one can not only speak about the positive consequences of using new media.

Table 17. shows that students do not connect computer usage with earth pollution.

	yes				sometimes				no			
	FGA		FPS		FGA		FPS		FGA		FPS	
Using computers for communication does not pollute the environment.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	57	52,3	22	21,0	8	7,3	10	9,5	44	40,4	73	69,5
Total	N=79 (36,9%)				N=18 (8,4%)				N=117 (54,7%)			

Table 17. Computer usage and pollution

Next three tables are showing data about support to higher prices as a compensation for environmental pollution. We can see that student are pretty divided around this topic. 37,9% is not sure, but 35,5% of students would support higher prices of electronic goods as a compensation for environmental pollution.

	yes				I am not sure				no			
	FGA		FPS		FGA		FPS		FGA		FPS	
I support higher price for CDs, as compensation for environmental pollution.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	53	48,6	23	21,9	22	20,2	59	56,2	34	31,2	23	21,9
Total	N=76 (35,5%)				N=81 (37,9)				N=57 (26,6%)			

Table 18. Support for higher CD prices

	yes				I am not sure				no			
	FGA		FPS		FGA		FPS		FGA		FPS	
I would support a higher price for computers, as compensation for environmental pollution.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	53	48,6	23	21,9	22	20,2	59	56,2	34	31,2	23	21,9
Total	N=76 (35,5%)				N=81 (37,9)				N=57 (26,6%)			

Table 19. Support for higher computer prices

	yes				I am not sure				no			
	FGA		FPS		FGA		FPS		FGA		FPS	
I would buy more expensive device if it's environmentally friendly.	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)	N	f(%)
	53	48,6	23	21,9	22	20,2	59	56,2	34	31,2	23	21,9
Total	N=76 (35,5%)				N=81 (37,9)				N=57 (26,6%)			

Table 20.

4.2 Analysis of difference in frequency of individual forms of (non)ecological attitudes according to faculty

Mann – Whitney U test for two independent samples has shown that there are statistically significant differences between students of Faculty of Graphic Arts and students of Faculty of Political Sciences in statements no. 2 ($p<0,05$), 4 ($p<0,01$), 5($p<0,01$), 6($p<0,01$), 7($p<0,01$), 8($p<0,01$). Groups are not statistically different in statements no. 1 and 3. Statement no.1 is the most general one, so no statistical differences between groups is logical. This two groups have different educational background regarding ecological topics, so their different attitude may come from this fact.

(Non)ecological attitudes	Faculty	Number	$\overline{R}$	U	p
I consider myself environmentally conscious person.	FGA	109	107,60	5712,000	0,980
	FPS	105	107,40		
2. Pollution of the Earth	FGA	109	115,00	4905,500	**0,040**
	FPS	105	99,72		
3 I consider myself personally responsible for the pollution of the Earth.	FGA	109	114,41	4969,500	0,066
	FPS	105	100,33		
4. Efficient disposal of electronic waste is important.	FGA	109	88,63	3740,000	**0,000**
	FPS	105	126,38		
5. I support a refund for returned bottles.	FGA	109	73,04	1966,000	**0,000**
	FPS	105	143,28		
6. Topics on environmental protection are adequately represented in education.	FGA	109	149,72	1120,500	**0,000**
	FPS	105	63,67		
7. Graphic industry is a big environment pollutant.	FGA	109	126,25	3678,500	**0,000**
	FPS	105	88,03		
8. I find available information about environment protection ...	FGA	109	97,57	4640,000	**0,008**
	FPS	105	117,81		

Table 21.

4.3 Analysis of difference in frequency of individual forms of (non)ecological behaviour according to faculty

Mann – Whitney U test for two independent samples has shown that there are statistically significant differences between students of Faculty of Graphic Arts and students of Faculty of Political Sciences in statements no. 1 ($p<0,01$), 2($p<0,01$), 3($p<0,01$), 6($p<0,01$), 7($p<0,01$), 8($p<0,01$), 9($p<0,01$), 10($p<0,01$). Students of Faculty of Graphic design are showing statistically significant different behaviour in most situations used in the test. The groups do not differ in the most active way of ecological behaviour – activism in NGO (they are not active at all).

(Non)ecological behaviour	Faculty	Number	$\overline{R}$	U	p
1. I recycle.	FGA	109	131,06	3154,500	**0,000**
	FPS	105	83,04		
2. I use green web pages.	FGA	109	117,16	4622,000	**0,000**
	FPS	105	97,02		
3. I properly disclose electronic waste.	FGA	109	120,91	4260,500	**0,001**
	FPS	105	93,58		
4. I actively participate in an environmental NGO.	FGA	109	107,50	5722,500	1,000
	FPS	105	107,50		
5. I properly disclose old newspapers.	FGA	109	110,72	5731,500	0,381
	FPS	105	104,16		
6. I take care of the spending electrical power.	FGA	109	119,00	4515,000	**0,000**
	FPS	105	96,42		
7. Using computers for communication does not pollute the environment.	FGA	109	90,39	3857,000	**0,000**
	FPS	105	127,27		

8. I would support higher price for CDs, as compensation for environmental pollution.	FGA	109	129,20	3443,500	**0,000**
	FPS	105	86,59		
9. I would support a higher price for computers, as compensation for environmental pollution.	FGA	109	129,20	3443,500	**0,000**
	FPS	105	86,59		
10. I would buy more expensive device if it's environmentally friendly.	FGA	109	129,20	3443,500	**0,000**
	FPS	105	86,59		

Table 22.

4.4 Analysis of correlation between (non) ecological attitude („I consider myself environmentally conscious person") and forms of (non)ecological behaviour

We wanted to test the correlation of positive ecological attitudes and ecological behaviour, so we used Spearmanov rho – we have chosen one statement (the most general one) and correlate it with statements about ecological behaviour. It seems, that there is almost no correlation with declarative environmental conscious and behaviour in real life. There is statistical significance in only two cases statements ($p<0,01$), if we look at this student population as a one group.

		I consider myself environmentally conscious person
I recycle.	rs	-0,111
	p	0,105
I use green web pages.	rs	-0,043
	p	0,530
I properly disclose electronic waste.	rs	-0,215
	p	**0,002**
I actively participate in an environmental NGO.	rs	.
	p	.
I properly disclose old newspapers.	rs	0,085
	p	0,218
I take care of the spending electrical power.	rs	-0,205
	p	**0,003**
Using computers for communication does not pollute the environment.	rs	0,089
	p	0,195
I would support higher price for CDs, as compensation for environmental pollution.	rs	0,128
	p	0,061
I would support a higher price for computers, as compensation for environmental pollution.	rs	0,128
	p	0,061
I would buy more expensive device if it's environmentally friendly.	rs	0,128
	p	0,061

Table 23.

If we look at the data separately according to the faculty, we can see some differences in correlations. Although, the data are showing inconsistency of students answers.

		I consider myself environmentally conscious person	
		FGA	FPS
I recycle.	rs	-0,034	-0,237
	p	0,727	**0,015**
I use green web pages.	rs	-0,093	0,087
	p	0,339	0,375
I properly disclose electronic waste.	rs	-0,201	-0,259
	p	**0,036**	**0,008**
I actively participate in an environmental NGO.	rs	.	.
	p	.	.
I properly disclose old newspapers.	rs	0,198	-012
	p	**0,039**	0,902
I take care of the spending electrical power.	rs	0,323	.
	p	**0,001**	.

Using computers for communication does not pollute the environment.	rs	-0,188	0,037
	p	0,051	0,734
I would support higher price for CDs, as compensation for environmental pollution.	rs	-0.506	0,243
	p	**0,000**	**0,012**
I would support a higher price for computers, as compensation for environmental pollution.	rs	-0.506	0,243
	p	**0,000**	**0,012**
I would buy more expensive device if it's environmentally friendly.	rs	-0.506	0,243
	p	**0,000**	**0,012**

Table 24.

5. Conclusion

Through the analysis of frequency of individual forms of attitudes and behaviour, we have found out which attitudes and types of behaviours are most represented. The results of the Mann-Whitney test of differences showed that there are statistically important differences according to faculty. Students of Faculty of Graphic arts are showing more forms of ecological behaviour. If we look the tables of ecological attitudes , we can see that they are gaining more information through formal education and they are much more satisfied with the amount of information they get. The results of Spearmanov rho test on one example has shown us that there is almost none correlation between ecological atittudes and ecological behaviour.

The issue of development, particularly sustainable development has become inevitable for all countries and humanity as a whole. Regarding printing technology, it can not be fully replaced by new technologies, but new technologies have enabled positive environmental changes in the printing process. The basic question that arises when we talk about new technologies is whether their use leads to reduced energy consumption and thus to increased environmental protection. The answers to these questions are not unambiguous. New technologies have been successfully implemented in the printing process, reducing the consumption of resources and completely thrown out some steps in the production process. Take into account that the introduction of expensive new technology, although long-term worth. With the advent of Internet, mobile phones and devices for reading electronic books and newspapers, paper for some kind of information has become secondary medium. New media are often glorified as an environmentally friendly, although many authors emphasize the problem of electronic waste and the fact that traditional printing process contains several resources that can be recycled. Studies show that electronic waste is the fastest growing waste, whose growth rates of 3-5% annually. Disposal of electronic waste is now a global problem with no solution in sight.

In particular, we emphasize the fact that the development of new technologies increases the environmental responsibility of the message recipient, ie. the media consumers. We as individuals can effect the changes by modification of our communication media habits and knowledge of the environmental consequences of our behavior.

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